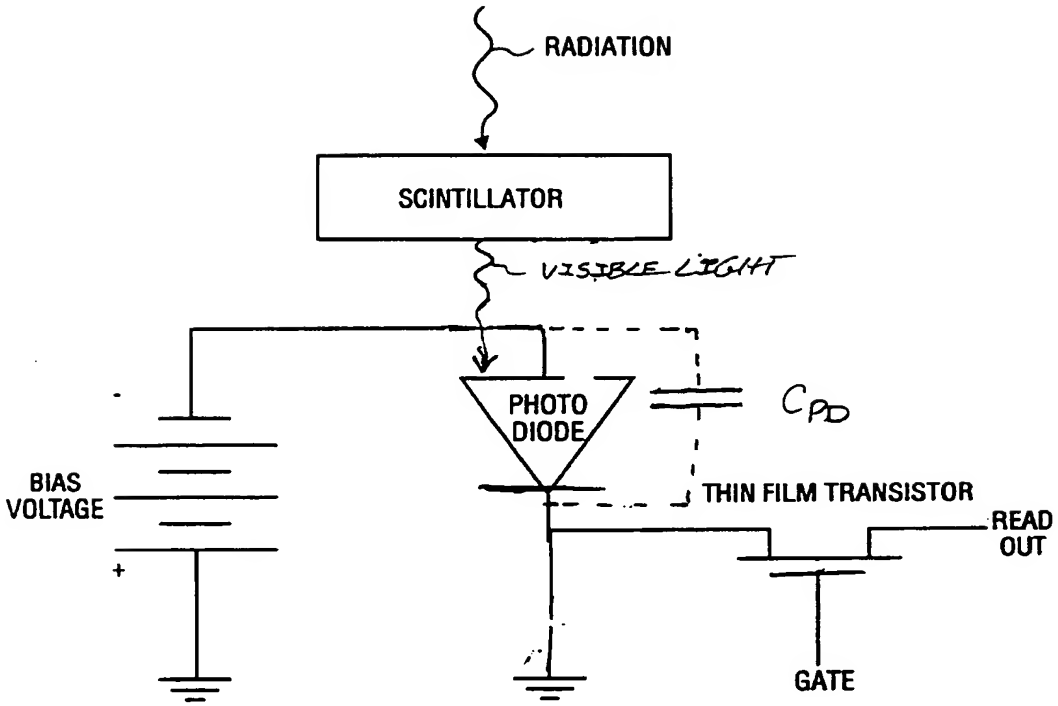

RADIATION
SCINTILLATOR
VISIBLE LIGHT
PHOTO DIODE
C_{PD}
BIAS VOLTAGE
THIN FILM TRANSISTOR
READ OUT
GATE

FIG. 1A

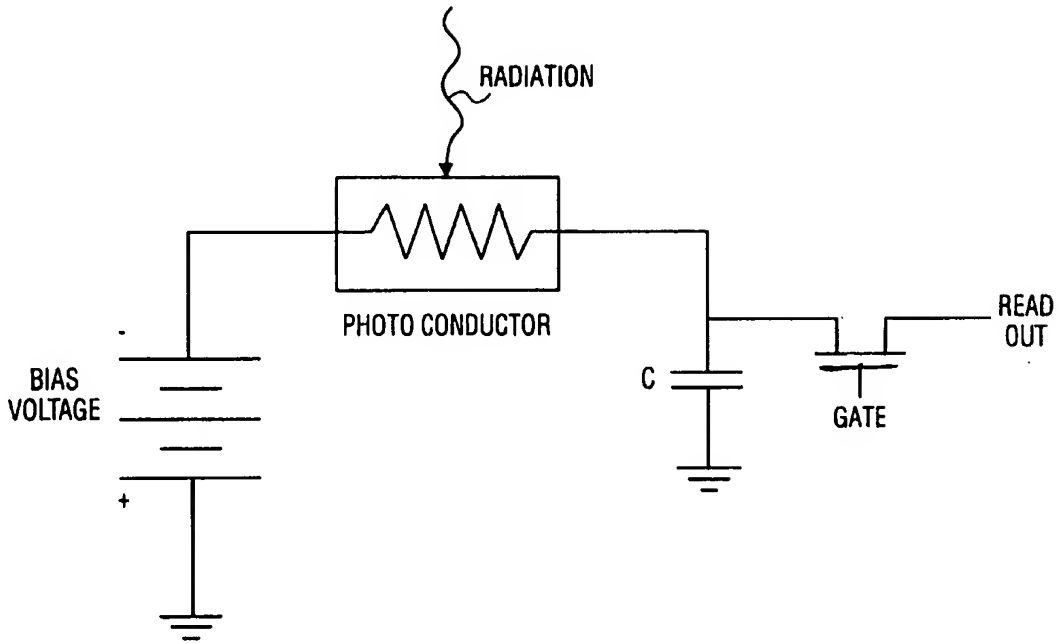


FIG. 1B

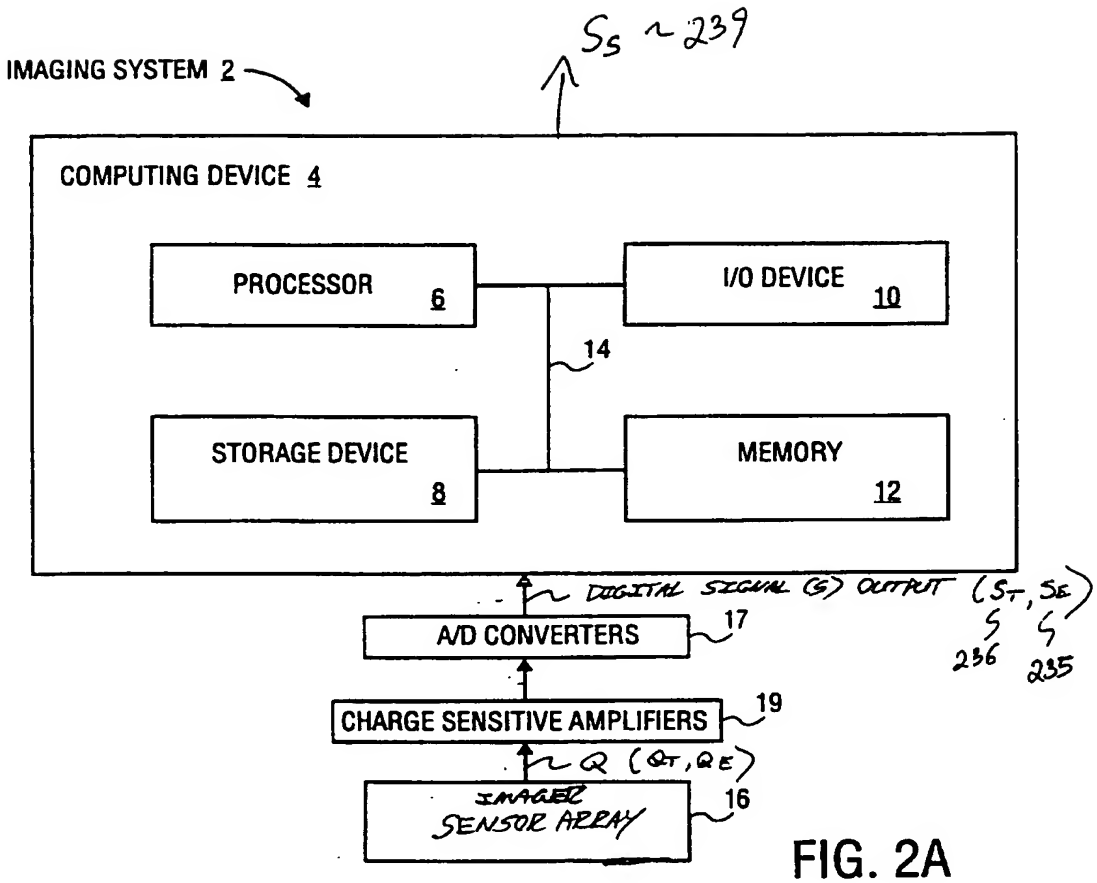

IMAGING SYSTEM 2
S_S ~239
COMPUTING DEVICE 4
PROCESSOR 6
I/O DEVICE 10
14
STORAGE DEVICE 8
MEMORY 12
DIGITAL SIGNAL (S) OUTPUT (S_T, S_E)
A/D CONVERTERS 17
CHARGE SENSITIVE AMPLIFIERS 19
Q (Q_T, Q_E)
IMAGER SENSOR ARRAY 16
236
235

FIG. 2A

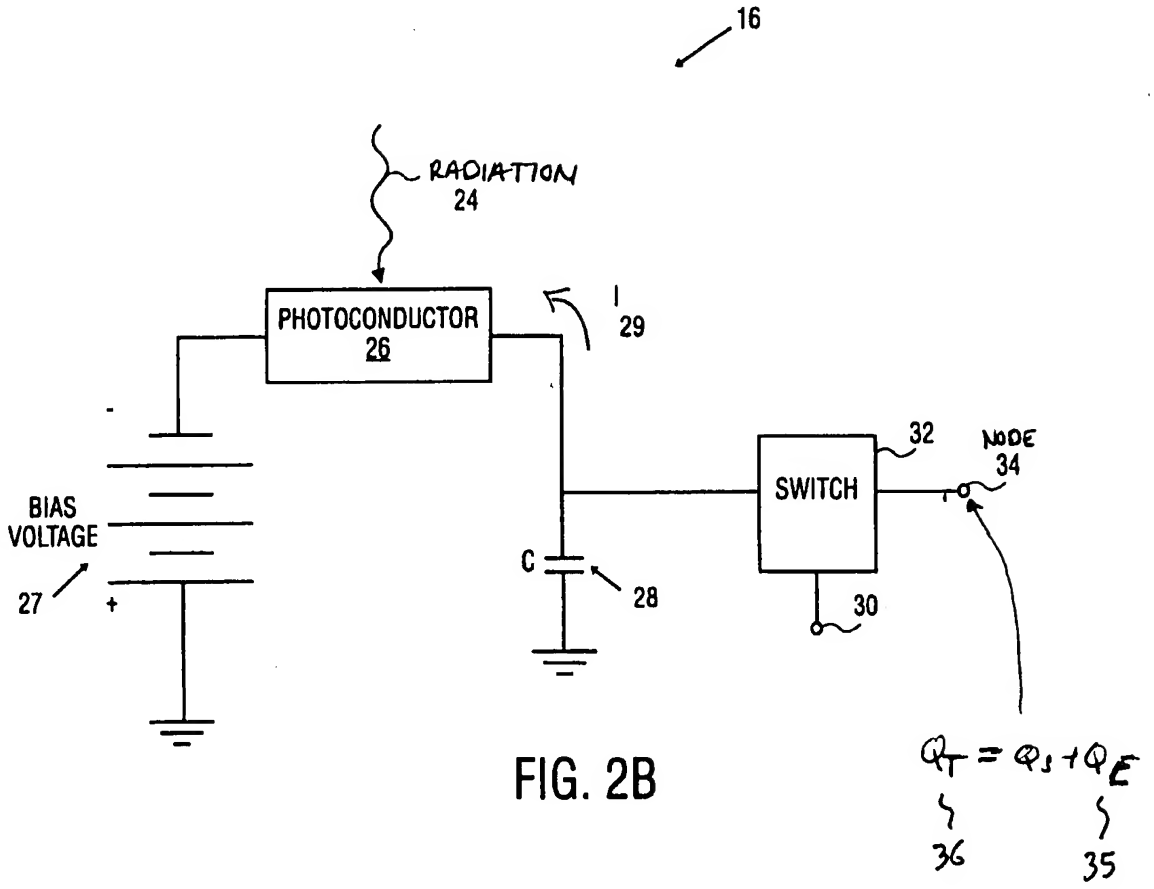

16
RADIATION
24
PHOTOCONDUCTOR
26
I
29
BIAS
VOLTAGE
27
-
+
C
28
SWITCH
32
NODE
34
30
$Q_T = Q_S + Q_E$
36
35

FIG. 2B

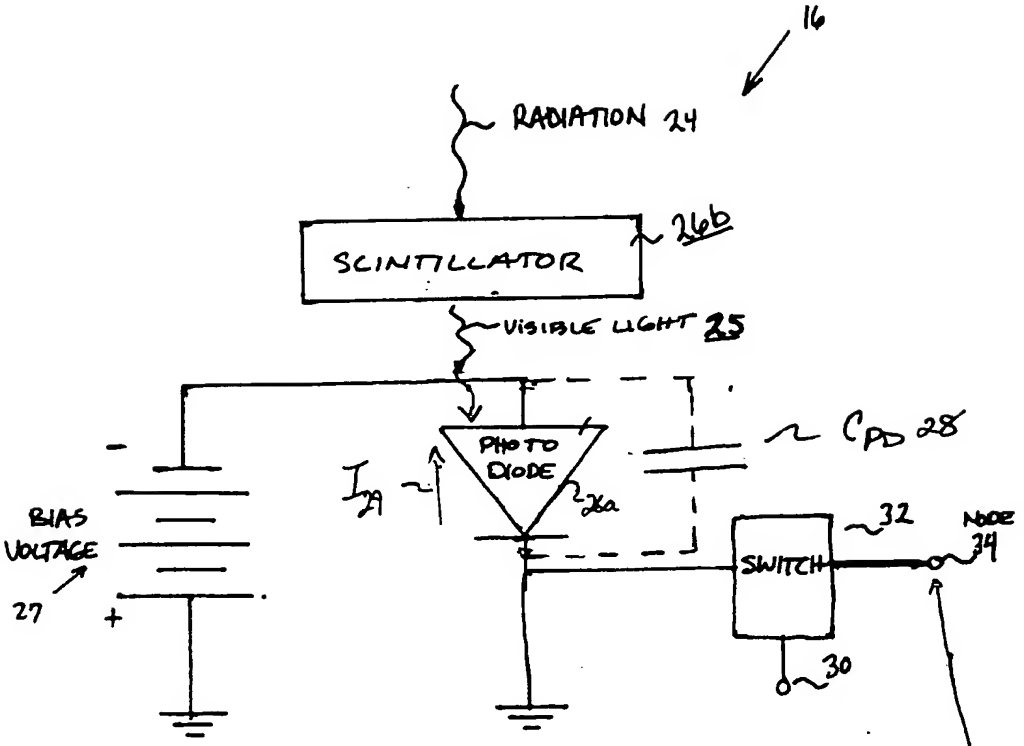

16
RADIATION 24
SCINTILLATOR
26b
VISIBLE LIGHT 25
C_{PD} 28
PHOTO DIODE
26a
I_{PH}
BIAS VOLTAGE
27
32
SWITCH
NODE 34
30
$Q_T = Q_S + Q_E$
36
35

FIG. 2C -

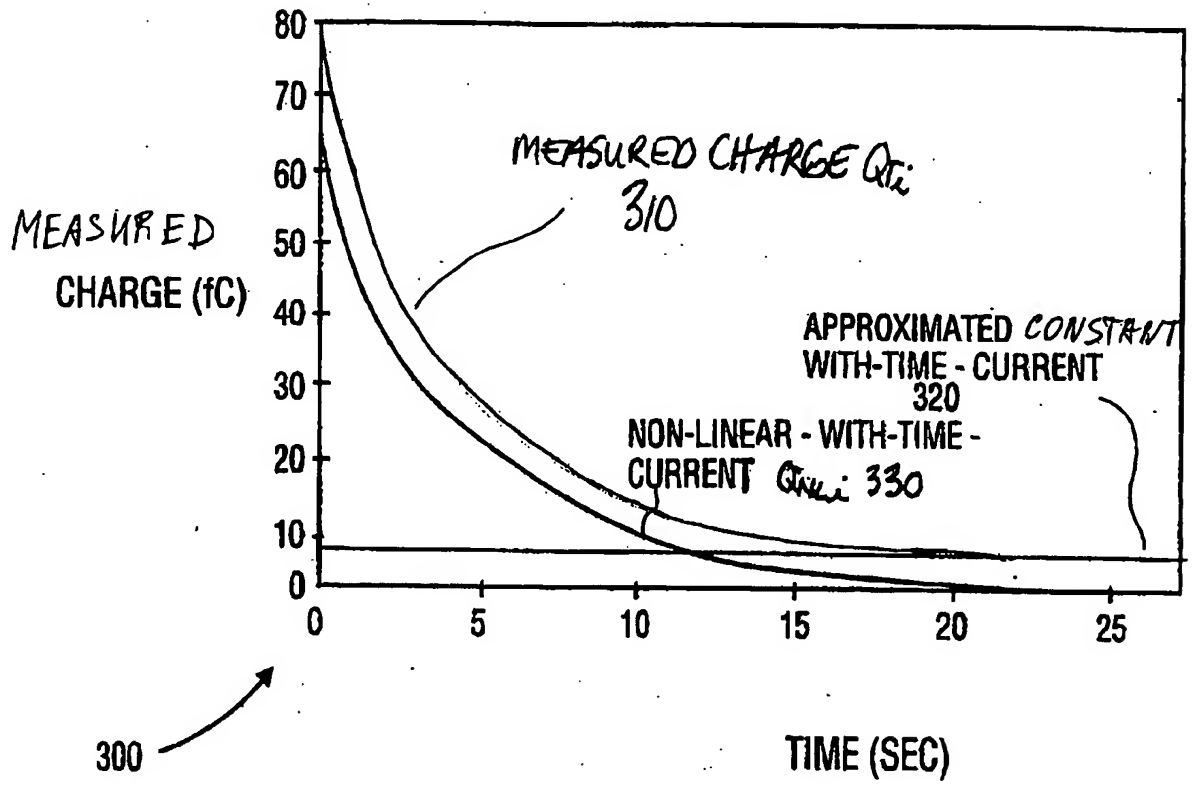

MEASURED CHARGE (fC)
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
TIME (SEC)
MEASURED CHARGE Q_{ti}
310
APPROXIMATED CONSTANT WITH-TIME - CURRENT
320
NON-LINEAR - WITH-TIME - CURRENT Q_{NLi} 330
300

FIG. 3

INTEGRATION TIME

$$I_E(t) = \frac{K}{t} \quad , \qquad Q_E(t) = \int_{t}^{t+T_i} I_E(t)\, dt$$

FIG. 4

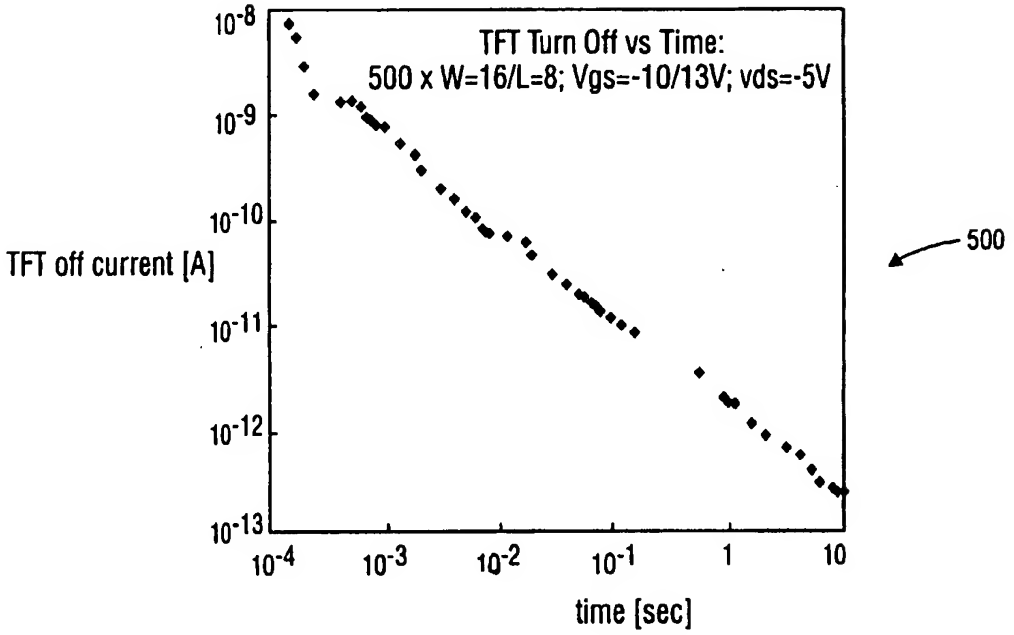

TFT Turn Off vs Time:
500 x W=16/L=8; Vgs=-10/13V; vds=-5V
TFT off current [A]
10-8
10-9
10-10
10-11
10-12
10-13
10-4
10-3
10-2
10-1
1
10
time [sec]
500

FIG. 5

$$\text{INTEGRATION TIME (t)} = \frac{1}{\text{FRAME RATE}}$$

FRAME RATE (FPS)	INTEGRATION TIME (SEC)
0.1	10
1	1
30	0.033
100	0.01

FIG. 6

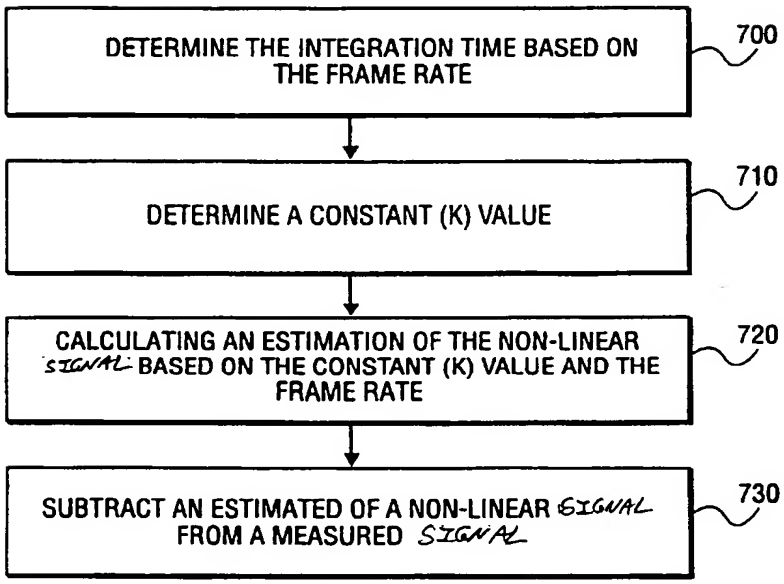


FIG. 7

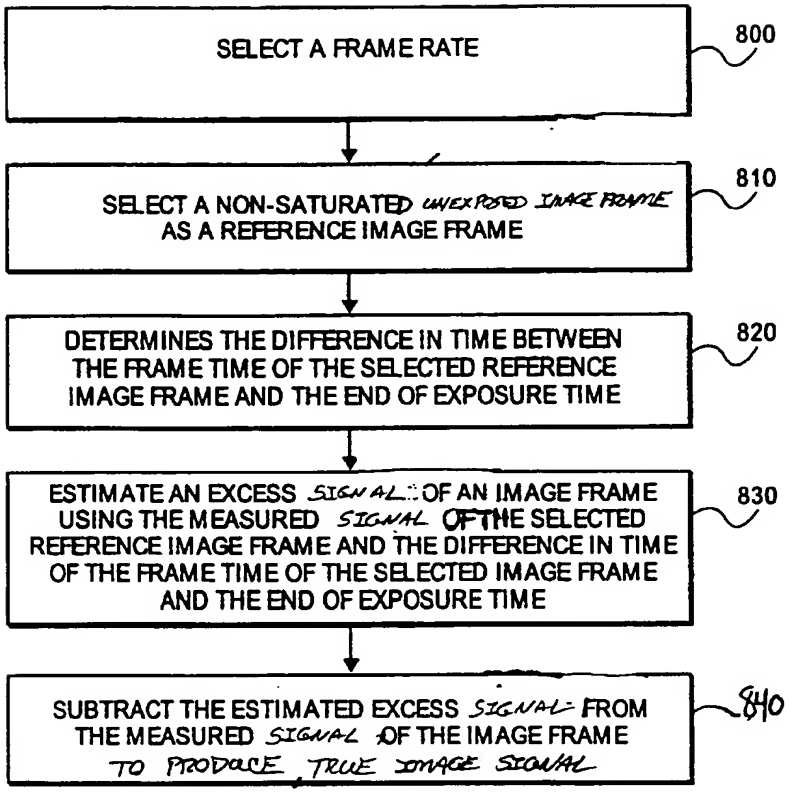

SELECT A FRAME RATE
800
SELECT A NON-SATURATED UNEXPOSED IMAGE FRAME AS A REFERENCE IMAGE FRAME
810
DETERMINES THE DIFFERENCE IN TIME BETWEEN THE FRAME TIME OF THE SELECTED REFERENCE IMAGE FRAME AND THE END OF EXPOSURE TIME
820
ESTIMATE AN EXCESS SIGNAL OF AN IMAGE FRAME USING THE MEASURED SIGNAL OF THE SELECTED REFERENCE IMAGE FRAME AND THE DIFFERENCE IN TIME OF THE FRAME TIME OF THE SELECTED IMAGE FRAME AND THE END OF EXPOSURE TIME
830
SUBTRACT THE ESTIMATED EXCESS SIGNAL FROM THE MEASURED SIGNAL OF THE IMAGE FRAME TO PRODUCE TRUE IMAGE SIGNAL
840

FIG. 8

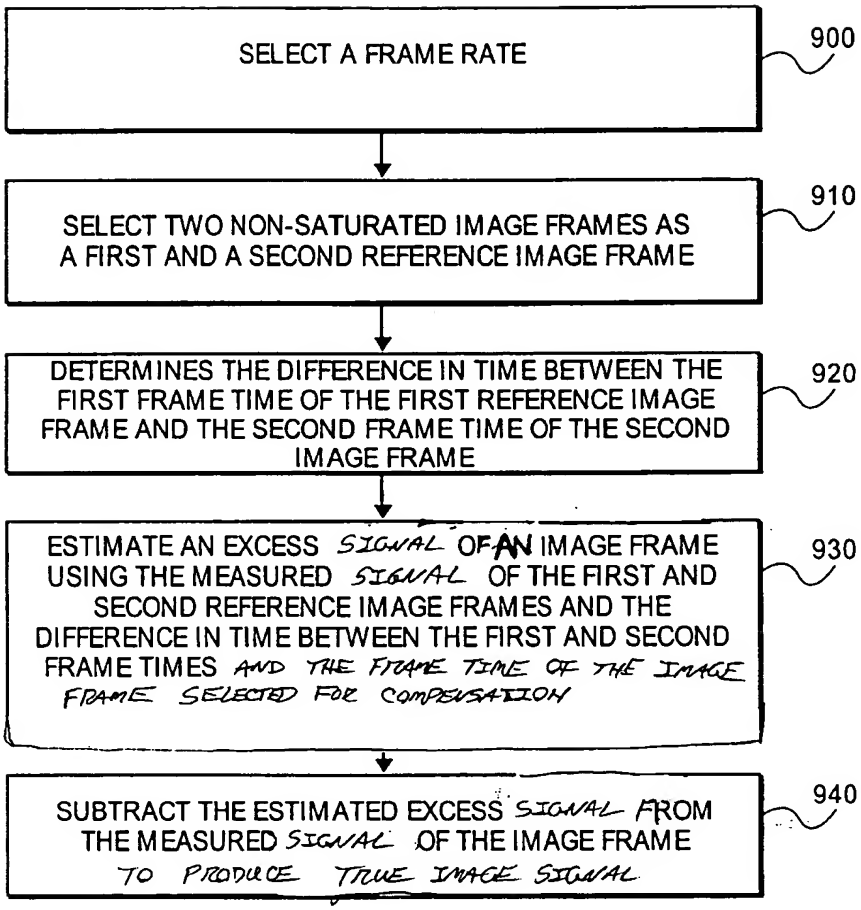
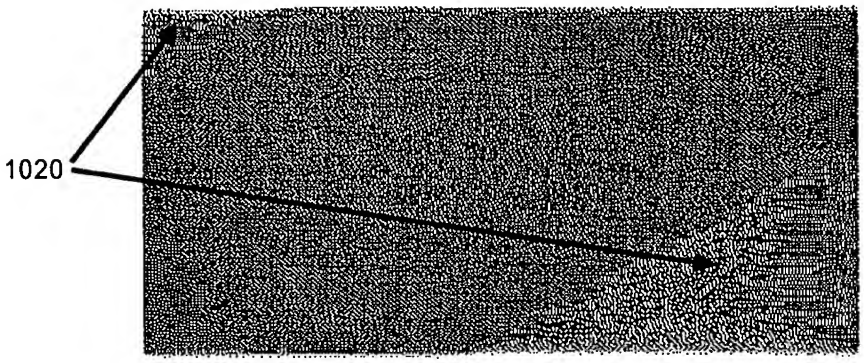

SELECT A FRAME RATE
900
SELECT TWO NON-SATURATED IMAGE FRAMES AS A FIRST AND A SECOND REFERENCE IMAGE FRAME
910
DETERMINES THE DIFFERENCE IN TIME BETWEEN THE FIRST FRAME TIME OF THE FIRST REFERENCE IMAGE FRAME AND THE SECOND FRAME TIME OF THE SECOND IMAGE FRAME
920
ESTIMATE AN EXCESS SIGNAL OF AN IMAGE FRAME USING THE MEASURED SIGNAL OF THE FIRST AND SECOND REFERENCE IMAGE FRAMES AND THE DIFFERENCE IN TIME BETWEEN THE FIRST AND SECOND FRAME TIMES AND THE FRAME TIME OF THE IMAGE FRAME SELECTED FOR COMPENSATION
930
SUBTRACT THE ESTIMATED EXCESS SIGNAL FROM THE MEASURED SIGNAL OF THE IMAGE FRAME TO PRODUCE TRUE IMAGE SIGNAL
940

FIG. 9

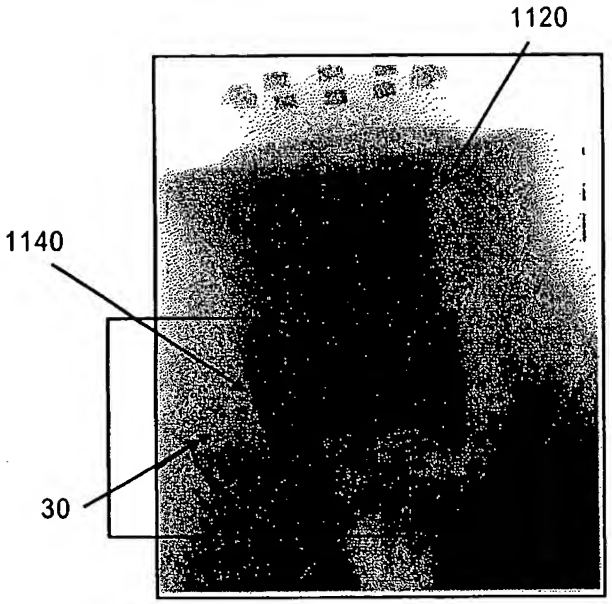


UNCOMPENSATED
FRAME F 1000

FIG. 10A

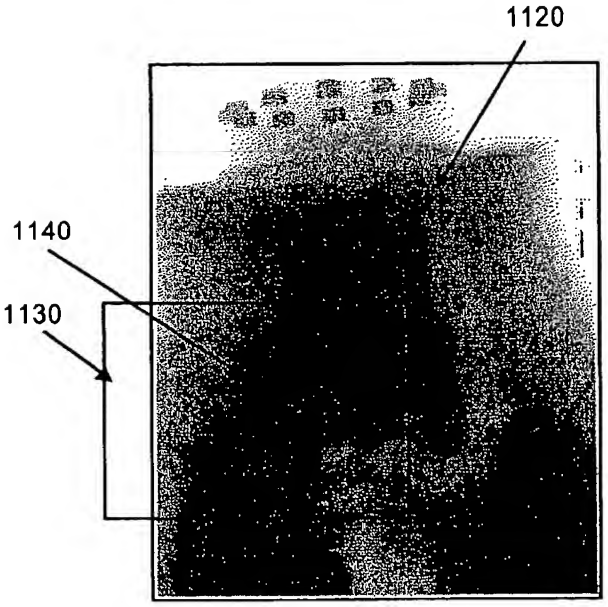
COMPENSATED
FRAME F 1010

FIG. 10B



UNCOMPENSATION FRAME
G1100

FIG. 11A



COMPENSATED FRAME
G1110

FIG. 11B

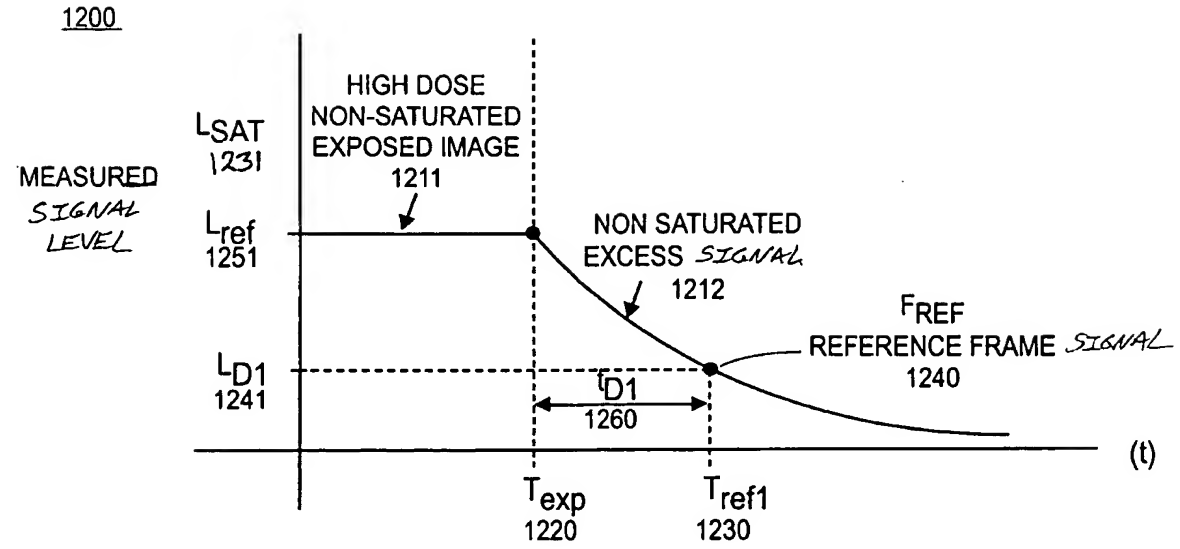

1200
HIGH DOSE
NON-SATURATED
EXPOSED IMAGE
1211
LSAT
1231
MEASURED
SIGNAL
LEVEL
Lref
1251
NON SATURATED
EXCESS SIGNAL
1212
FREF
REFERENCE FRAME SIGNAL
1240
LD1
1241
tD1
1260
(t)
Texp
1220
Tref1
1230

FIG. 12

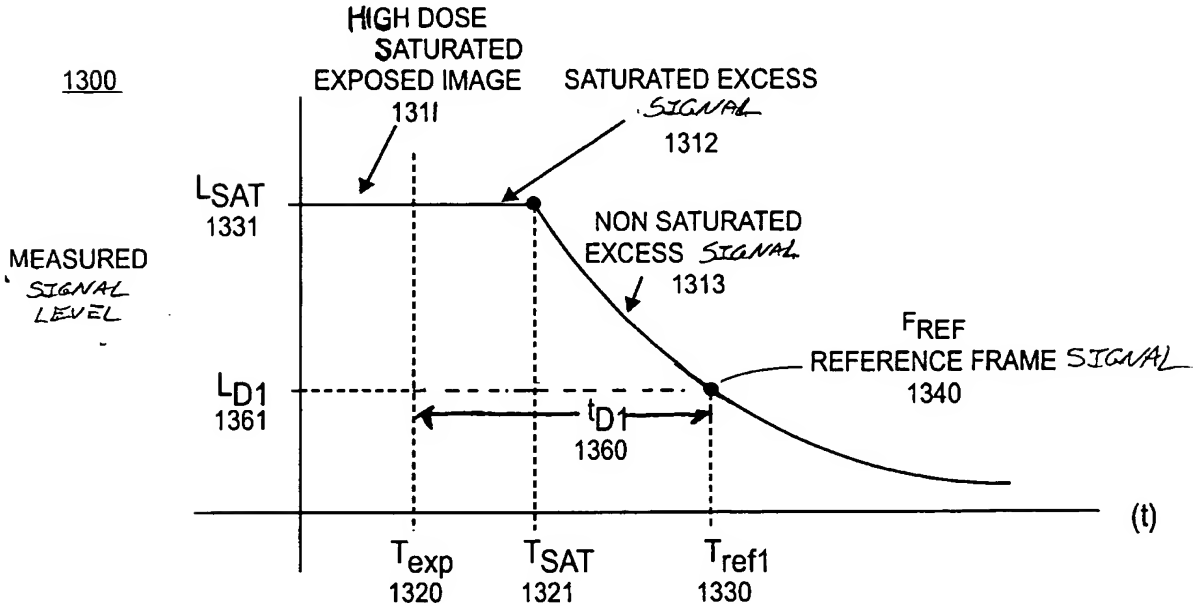

1300
HIGH DOSE
SATURATED
EXPOSED IMAGE
1311
SATURATED EXCESS
SIGNAL
1312
LSAT
1331
MEASURED
SIGNAL
LEVEL
NON SATURATED
EXCESS SIGNAL
1313
FREF
REFERENCE FRAME SIGNAL
1340
LD1
1361
tD1
1360
(t)
Texp
1320
TSAT
1321
Tref1
1330

FIG. 13

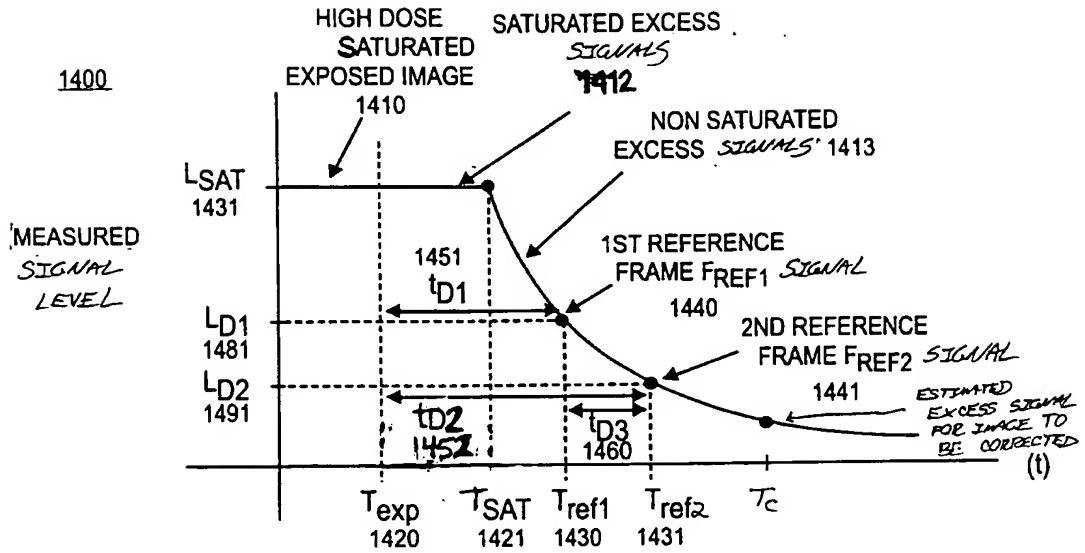

1400
HIGH DOSE SATURATED EXPOSED IMAGE
1410
SATURATED EXCESS SIGNALS
1412
NON SATURATED EXCESS SIGNALS 1413
MEASURED SIGNAL LEVEL
LSAT
1431
1451
tD1
1ST REFERENCE FRAME FREF1 SIGNAL
1440
LD1
1481
2ND REFERENCE FRAME FREF2 SIGNAL
1441
ESTIMATED EXCESS SIGNAL FOR IMAGE TO BE CORRECTED
LD2
1491
tD2
1452
tD3
1460
(t)
Texp
1420
TSAT
1421
Tref1
1430
Tref2
1431
Tc

FIG. 14

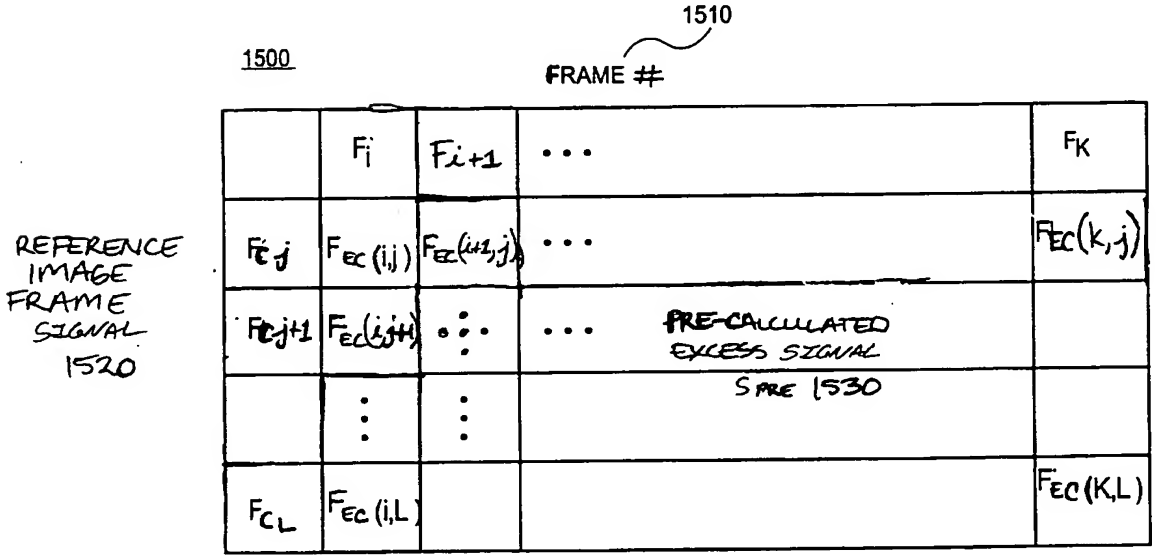

1510
1500
FRAME #
REFERENCE IMAGE FRAME SIGNAL
1520
Fi
Fi+1
FK
Fi j
FEC(i,j)
FEC(i+1,j)
FEC(k,j)
Fi j+1
FEC(i,j+1)
PRE-CALCULATED EXCESS SIGNAL
SPARE 1530
FC L
FEC(i,L)
FEC(K,L)

FIG. 15

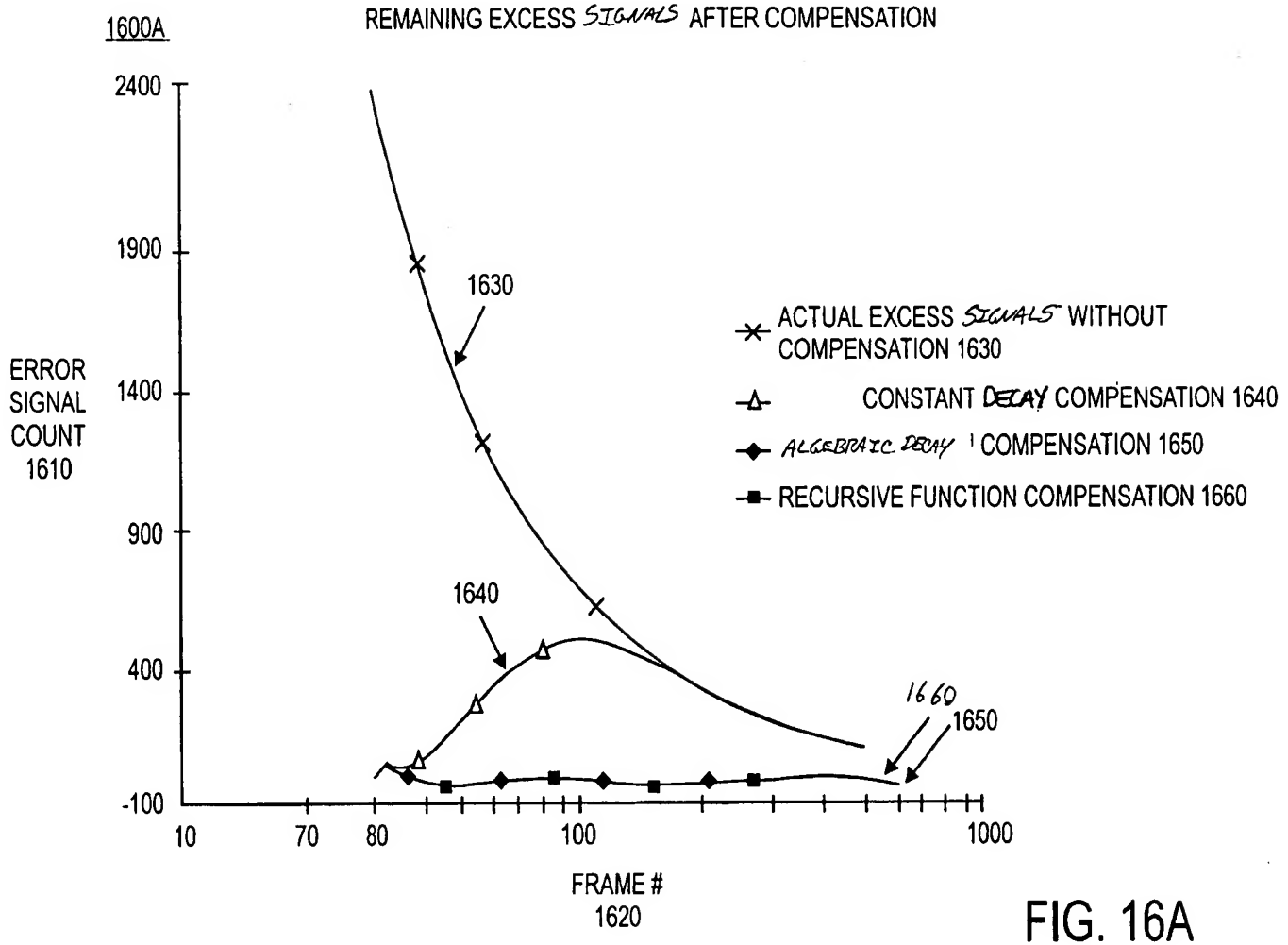

1600A
REMAINING EXCESS SIGNALS AFTER COMPENSATION
2400
1900
1400
900
400
-100
ERROR SIGNAL COUNT 1610
1630
1640
1660
1650
ACTUAL EXCESS SIGNALS WITHOUT COMPENSATION 1630
CONSTANT DECAY COMPENSATION 1640
ALGEBRAIC DECAY COMPENSATION 1650
RECURSIVE FUNCTION COMPENSATION 1660
10
70
80
100
1000
FRAME # 1620

FIG. 16A

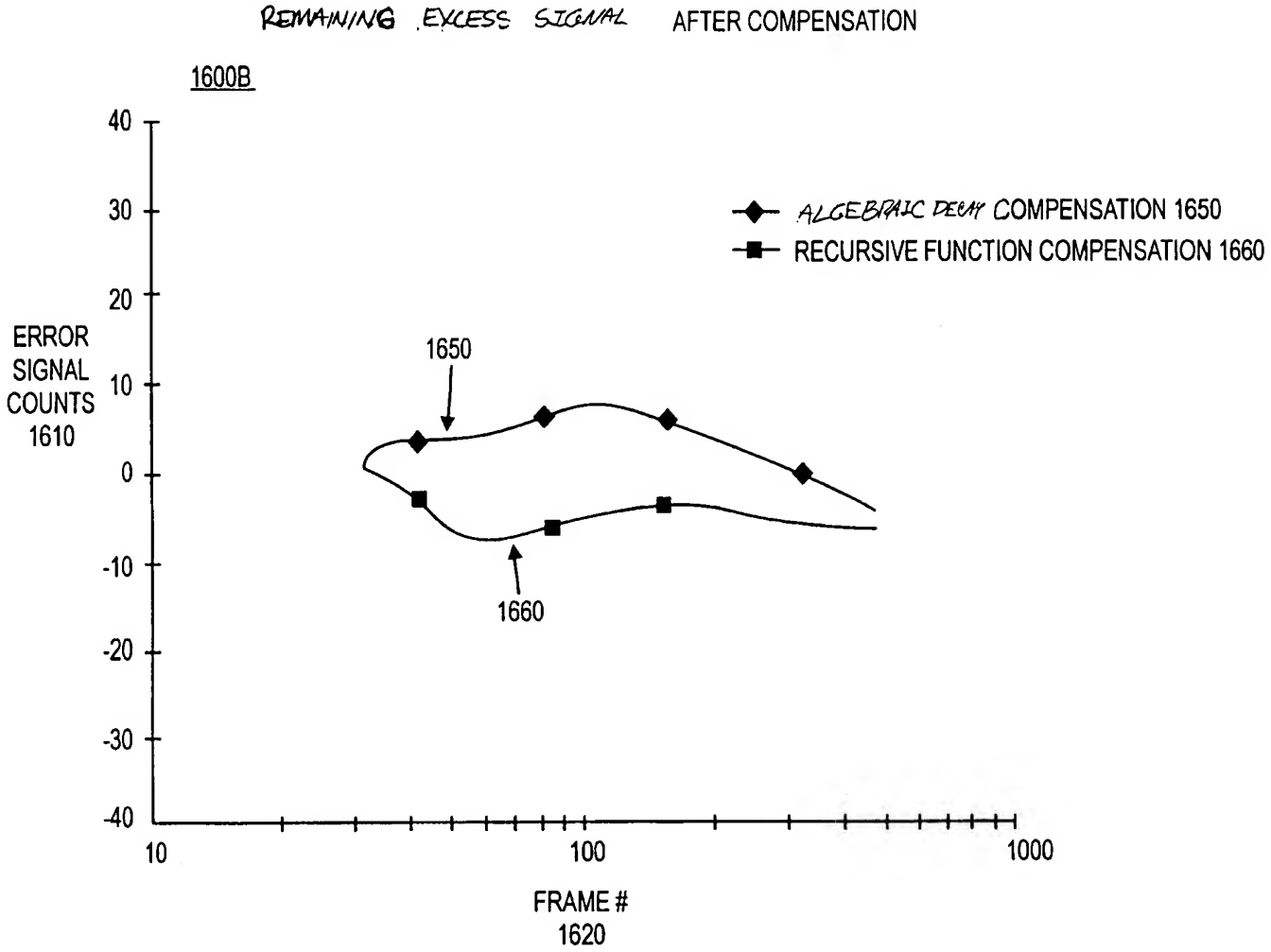

REMAINING EXCESS SIGNAL AFTER COMPENSATION
1600B
40
30
20
10
0
-10
-20
-30
-40
ERROR SIGNAL COUNTS 1610
ALGEBRAIC DECAY COMPENSATION 1650
RECURSIVE FUNCTION COMPENSATION 1660
1650
1660
10
100
1000
FRAME # 1620

FIG. 16B